DEVELOPMENT OF A COSTING SYSTEM FOR A CHEMICAL PATHOLOGY LABORATORY IN A PUBLIC HOSPITAL BY ACTIVITY BASED COSTING METHOD

by

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ABSTRACT

This project intended to develop a costing system for a Chemical Pathology Laboratory of a public hospital in Hong Kong using Activity Based Costing method. Activities in the laboratory studied was analyzed to establish several functionally distinct modules. Cost in each of the modules were identified and charged independently of each other.

The system so developed was flexible. Any change in the laboratory activities do not require amendment in the whole system but only the related modules. The cost compositions of the products were made more transparent. These provided more information to the management for decision making as comparing to the traditional costing methods.

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CHAPTER I

INTRODUCTION

Background

This Project was the first attempt to develop a costing system for the laboratories in public hospitals in Hong Kong.

After reviewing of literature, it was shown that such system was uncommon or very rudimentary in this profession even in other developed countries(Ericksen, 1993; Logan 1989). Formal literature in the area of product costing in health care profession was small in quantity, very variable in quality and has been applied only in an elementary fashion to pathology costing(Conyers, 1993).

Costing is an important element of management information. The information gathered could be useful for the laboratory management, to name just a few, for the following(Ericksen 1993; O'Leary, 1993):

- facilitating management control over the acquisition and efficient use of resources;
- assisting in fulfilling strategic objectives by communicating management plans and policies;

- in the preparation of annual business plans;
- in the provision of accurate costs for research projects;
- in negotiation with industry representatives

Objective

The objective of this project was to development a costing system for the Chemical Pathology department in a major teaching hospital in Hong Kong based on the Activity Base Costing (ABC) method. The department to be studied was a non-profit making Chemical Pathology department in a teaching hospital.

In this changing climate of medical system after the establishment of the Hospital Authority, there is increasing demand for management information for rational decision making.

It was very difficult, if not impossible, to find the 'true cost' for each individual test (for instance, the capital investment on land). Some of the cost incurred was borne by the hospital level such as overhead for electricity, lighting, air conditioning, general cleansing, personnel management etc. It was also not very meaningful to find out the true cost. It is important to ask the right question before one can get the right answer. Only the budget allocated to the departmental was under the direct control of the

department. The budget allocated to the department was mainly for two purposes, the personnel emolument budget and a yearly reviewed budget for consumables. Hence it was more meaningful to find out how the money was spent in different analysis activities.

The analysis process was the major workload of the department. Because of time constrain, 3 selected cost objects in the analysis process were studied in detail to find out the costs. These included the Dimension section, the Toxicology section and the Immunoassay (IMx) section.

The Department

Background

Chemical pathology is a branch of pathology. One of the main function is to analyze various patient tissues to help the clinical management of patients.

This analytical activities can be considered as a kind of production function. The patient's tissue (a blood sample, for instance) is 'processed' to produce the final 'product' which is a laboratory report.

These processes, however, are not homogenous. There were more than two hundred different tests offered to the

clinician, each of them can be viewed as a different product. The production of which, involves different stages, material and labour input. They share, however, some common processes. These properties make it attractive to apply the Activities Based Costing system to these functions(Johnson, 1988; Cooper, 1990).

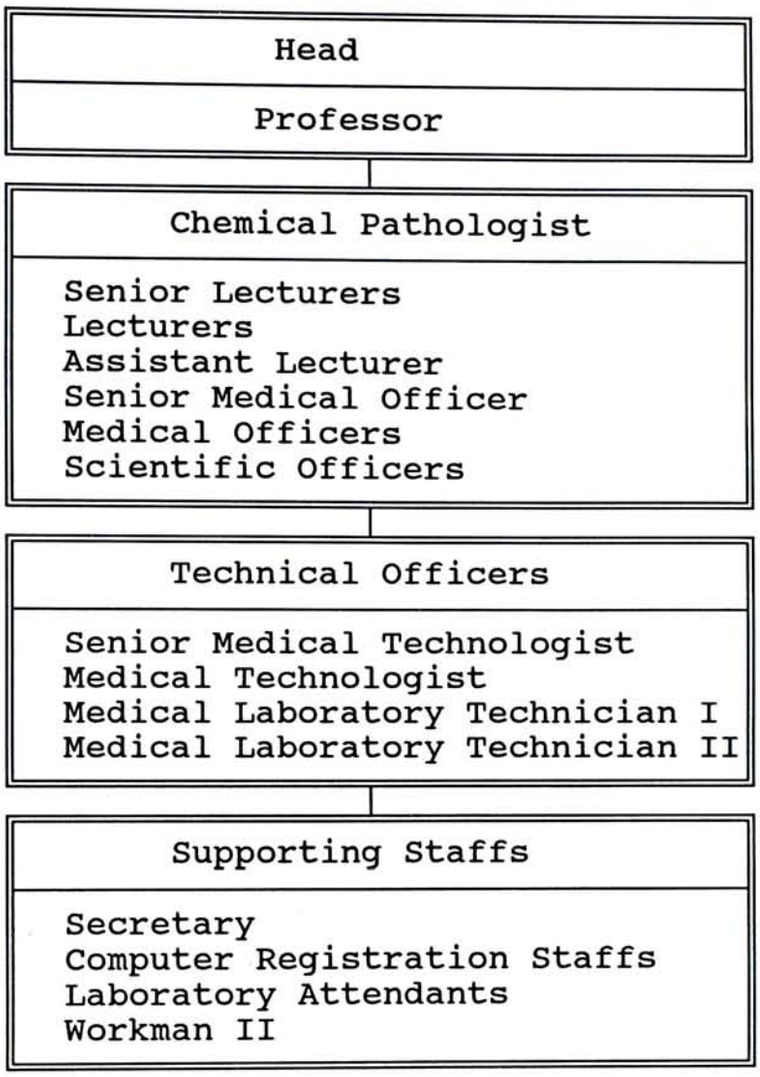
The ABC requires a detailed study of the process to identify the various activities required to produce the product. Through these studies, some **homogeneous cost objects** were identified. A **pool rate** was developed for each cost object, for which a **cost driver** was identified to apply the cost.

Organisation Structure

The department to be studied was a Chemical Pathology department in a teaching hospital in Hong Kong. It was a hybrid department composed of staffs employed by the university and the Hospital Authority(HA). The routine services, which was the scope of this study, was a function of the HA side. But all the teaching staffs of the University also contributed to this function. Moreover, some of the HA staffs also participated in the university activities in terms of academic research and teaching. The mixed role of these staffs were studied to identify their contribution to the routine services.

The following organisation chart illustrates the routine

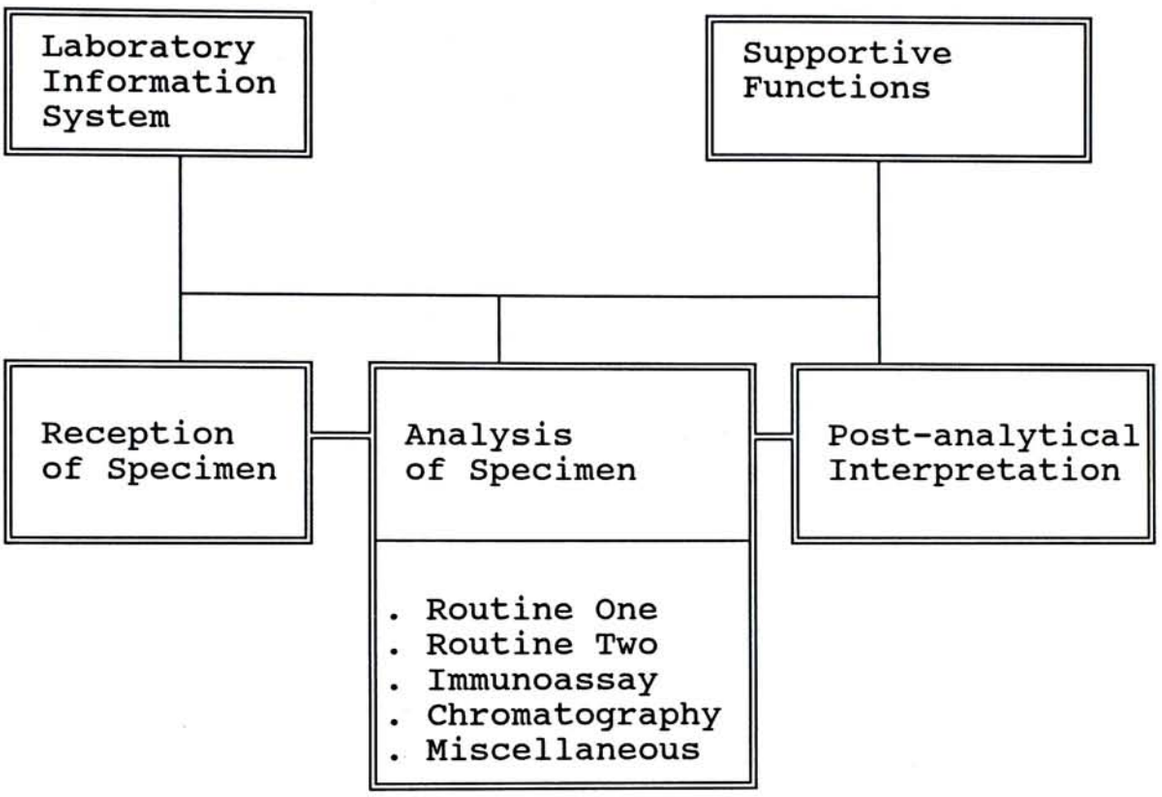
function :



Each staff's contribution to the routine services was delineated and their labour costs were allocated to the routine services.

The work process

The complete work process involved the following steps :



Reception of Specimen

All specimens came to the Reception section of the department. These specimens were then checked to ensure that the right specimens were sent for the tests requested. The specimens were then centrifuged and separated to different containers (specimen cups) to be distributed to different analytical benches.

Analysis of Specimen

The laboratory was divided into 5 main **branches.** Each bench was composed of several **sections.** The production function in each **section** was relatively homogenous (e.g. use the same machine to produce a range of different tests). Each section served as a homogenous cost object.

Branch	Section
Routine One	Dimension
Routine Two	Astra Urgent Others
Immunoassay	IMx RIA 1 RIA 2 ACS
Chromatography	Toxicology IEM Remote
Miscellaneous	Atomic Absorption Cobas Bio Manual

Post-analytical interpretation and validation of results

A group of Chemical pathologist was responsible for interpretation and quality assurance function for the analytical results. Their contribution were identified and allocated to the tests.

Laboratory Information System

A team of computer officers / operators was employed by the hospital to maintain the information system. This system served many other departments and other activities (such as research). Most of these were not under the direct control by the Chemical Pathology department. Only the staffs under the direct control of the department were included in the study.

All request orders were registered into the laboratory computer system. This served as a database. All subsequent analytical steps required some interaction with this database. Staffs in this section were also responsible for answering enquiries, filing of the order forms and order activities related to the registration process.

Supportive Function

Some material cost or activities of the staffs of the department could not be traced down to any particular analytical sections. These included some portions of the time of the Chemical Pathologists, the Senior Medical Technologist (SMT) and the secretory. Some indirect material cost like stationary, photocopying and some departmental wide overhead also shared this nature. These formed another cost object. A separate pool rate was developed to allocate this cost.

CHAPTER II

METHODOLOGY

Overview

Cost incurred for each of the activities mentioned above have been studied systematically by employing Activity Based Costing (ABC) method. Under ABC method, each activity was a cost object. The activities involved in each process have been analyzed to determine the appropriate cost objects. Based on the different activities involved, appropriate **cost drivers** have been identified.

Once a cost object and the cost driver were determined, the total cost incurred in that cost object were identified. This include the direct and indirect labour cost, material cost and overhead cost. Cost data for the period under investigation were obtained by direct interviews, questionnaires, inspection of historical records, retrieving and analyzing information from the information system. A pool rate was calculated, which form the basis of allocating cost to individual test. The beauty of a 'ABC' system is that it

allows any change or unidentified cost to be added to the total cost of that cost pool, without disturbing the pool rate developed in other pools. The pool rate of any cost pool, hence the cost incurred, in case of change, can be updated easily (Johnson, 1988; Cooper, 1990). The pool rate was calculated by dividing the total cost incurred by the cost driver.

Activities in the analytical process required special consideration. Because the activities in the analytical level were very heterogenous, it was impossible to define a common cost pool for all the tests. The tests have been divided into a number of functional areas, each of which was homogenously enough to allow the formation of a single cost object. Pool rates have been developed for several selected cost objects.

Direct material was the major cost incurred. This component was very heterogenous even within the same cost object. To avoid undue inaccuracy, this cost was charged separately to each test.

Unit Labour Cost of technical staff

There were three different grades of technical staffs involved in the direct analysis. Since their functions were similar, and in most of the time interchangeable, a **unit labour cost of technical staff** was developed. This was achieved by taking the mid point of each grade of staffs together with the fringe benefit to calculate the weighted

average cost. Standardised fringe benefit cost has been developed by the Hospital Authority in terms of certain percentage of the basic salaries.

Reception

All tests, irrespective of subsequent activities concerned, required similar input in the reception area. These input included scrutinising the request order, processing the specimen by centrifugation, alliquating and delivering the specimen.

All cost incurred in this process, including labour and material, have been identified. A cost driver has been developed for activities in this section. This was called **activity-unit**. An **activity-unit** was broadly equivalent to the activities involved in processing one ordinary test. Hence, the **activity-unit** for most tests equalled to 1.

One important exception was the tests performed by the major automated analyzer - **the Dimension**. This machine was responsible for handling 19 tests which were the most frequently ordered tests in the department. The machine was fully automated. The activity performed by the reception was **independent** of the **number of tests** ordered to this machine i.e. the material and labour cost in the reception area for this machine was identical irrespective of the number of tests ordered. To avoid unnecessary distortion by this machine, the **activity-units** for tests belonged to this machine have been

deflated by the average number of tests in the Dimension test order.

For an order with Dimension tests, the number of tests ordered to the Dimension could range from 1 to 19. Irrespective of the total number of tests ordered to the Dimension, the **activity-unit** assigned to the Dimension tests was 1 to reflect the special nature. For example, in a particular order, the total number of tests ordered to the Dimension was 4, then the **activity-unit** for each of the 4 tests would be 0.25. Take a second example, if the total number of Dimension tests ordered were 10, then the **activity-unit** for each of the 10 tests would be 0.10. The **activity-units** for each of the 19 tests were established by averaging 3000 orders. These 3000 orders were retrieved from the information system from 1 February 1993 onward.

Deflating the activity-units for the Dimension tests could thus avoid distortion of the true picture, otherwise, the cost charged to the Dimension tests and other non-Dimension tests would be inaccurate.

Analysis of Specimen

These were the processes where costs incurred were most significant.

There were five main branches, each with one or more sections. Each section was a cost objects. Three cost objects were selected to study the costs incurred. The three

cost objects included were the Dimension section, the Toxicology section and the Immunoassay (IMx) section.

In each of these three selected cost objects, cost for each tests were obtained. Cost charged to the tests in these processes was composed of the direct material (DM) cost, the direct labour (DL) cost and the overhead (OH) cost.

Direct material cost

Because direct material cost was very heterogenous even for tests in the same cost object. To avoid undue inaccuracy, direct material cost was charged to the test concerned directly.

The average cost of direct material was determined by reviewing the invoices, delivery notes and purchase orders from 1 January to 31 December 1993. The unit direct material cost (i.e. the direct material cost for performing one test) was derived by dividing the total direct material cost by the total test number in the year 1993 for that particular test.

In case when reliable data cannot be obtained, or there was a change of method in the year 1993, a shorter period within the year 1993 was used to calculate the direct material cost.

Direct labour

Total labour cost was calculated by multiplying the **unit labour cost of technical staff** by the total expected labour time. It was assumed that a technical staffs worked 7 hours a day on week days and 3.5 hours on Saturday. A time study has been conducted for one month (15 January 1994 to 14 February 1994) in the 3 selected cost objects(see appendix I). The average time involved in performing a test was calculated. This formed the basis of the DL time for each test.

The **direct labour cost** was the DL time required timed the unit labour cost of technical staff. The **indirect labour cost** was obtained by subtracting the **direct labour cost** from the **total labour cost.**

Overhead rate

Apart from direct material cost, DL cost was the most significant cost incurred for each test. The DL time for each test was the most logical cost driver for allocating the overhead (OH) cost, including indirect labour cost and indirect material cost.

The **cost driver** in this cost object was the **minute direct labour time.** This was not only the cost driver for allocating the DL cost, but also the OH cost. It was decided that the cost of DL and OH were reported separately to provide more

information.

The **OH rate** developed was the total cost incurred in this cost object **apart from the DM** and **DL** divided by the total DL time in the cost object.

Total cost incurred in this cost object

The cost incurred for a test in this cost object was the summation of the DM cost, DL cost and OH cost. This was given by the following formula :

Cost incurred in this cost object

= Direct material cost

+ (Unit Labour cost x DL time in minutes)

+ (OH Rate x DL time in minutes)

Post-analytical interpretation and validation of results

Results of all tests required interpretation and validation by a Chemical Pathologist. One Chemical pathologist was responsible for such function daily. The total labour cost for this function has been calculated, which was the total cost incurred for this activity for the year 1993.

The cost driver in this cost object was the **activity-unit** described previously. This cost driver was used to avoid distortion by the Dimension tests as mentioned above. The pool rate in this cost object was derived by dividing the cost

incurred by the total activity-unit in 1993.

Laboratory Information System

The laboratory information system was maintained by a team of computer personnel. This system served other pathology departments as well. Strictly speaking, all costs incurred in this function should be traced and allocated appropriately to the chemical pathology tests. But as mentioned in the introduction, this costing system was developed to facilitate the managerial decision making in the department, this team of computer personnel and the material / overhead incurred were not under the control of the department. To simplify the situation, only the computer staffs allocated to the department for the daily registration, enquiry and other related function have been studied. The cost incurred in this cost object was simply the salaries of these three staffs. The cost driver for this cost object was the **request**.

Most tests come in groups. i.e. in a single request form, there were usually more than one test requested. The request (an order) was the natural cost driver. The information required to be registered into the computer include the demographic data of the patient, the location, the laboratory number ... etc. This was the main bulk of work. The number of tests requested, be it one or many, influenced

the registration time minimally. So the pool rate was developed to allocate the cost for one **request.**

The actual cost incurred for an individual **test**, however, was more sophisticated. Since more than one tests could be ordered in a request form. To account for this fact, **request-equivalents** were developed for each test to allocate the cost to individual test. **Request-equivalent** for each test corresponded to the portion of effort spent to one request by this cost object. With one test requested in an order, the **request-equivalent** was one. With two test ordered, the request-equivalent was 0.5 for each. With 10 tests ordered, the request-equivalent was 0.1 for each of the 10 tests. For each test, 3000 requests, started from 1 February 1993 onward, with that particular test ordered were reviewed to establish the **request-equivalent** for that particular test. The cost incurred for a test in this cost centre was calculated by multiplying the pool rate by the request-equivalent of that particular test.

Supportive function

Some material inputs, overhead and some activities of certain staffs of the department could not be traced down to individual tests. These included the managerial activities of some chemical pathologist, the senior medical technologist(SMT) and the secretaries.

While all the time of the SMT and the secretaries were

devoted to the routine services, the functions of the Chemical Pathologist were quite diversified. They were involved in activities like academic research, teaching, and direct patient contacts in clinics and consultation etc. These activities were not part of the routine production function of the department and should not be counted. This has been analyzed by means of a questionnaire to all the Chemical Pathologist (see appendix II).

Since a Chemical Pathologist was responsible for the **post-analytical interpretation and validation** everyday, this portion was deducted to obtain their contribution allocated to these other activities. All material expenditure and overhead which could not be allocated to other cost objects were allocated to this cost object.

The cost driver for this cost object was the **request number.** To more accurately reflect the true cost incurred, the **request-equivalent** developed for each test was used as the basis of allocation. The pool rate was obtained by dividing the total cost incurred by the total number of request in the year 1993.

CHAPTER III

RESULTS

Weighted-average Labour Cost of a technical staff

Labour cost of the 3 grades of technical staffs were weighted-averaged as below :

Grade	Number of staff	Cost per staff per year	Total Cost per Year
MT	18	$ 428,987	$ 7,721,766
MLT1	1	$ 325,779	$ 325,779
MLT2	10	$ 212,597	$ 2,125,970
Total	29		$ 10,173,515

MT = Medical technologist
MLT1 = Medical laboratory technician I
MLT2 = Medical laboratory technician II

Weighted average :

= $ 10,173,515 / 29

= $ 350,810 / technician / year

= $ 2.9 / technician / minute

Reception

After identifying and calculating the cost driver, which was the activity-unit for the cost object, the total cost incurred was obtained. The pool rate was subsequently developed by dividing the total cost incurred by the cost driver.

Activity-unit

After interviewing the section head and observing the request patterns, it was concluded that all **tests** share similar proportion of input from this cost centre except those to **the Dimension.**

The **Activity-unit(AU)** for all tests equal to 1 except those tests belonged to the Dimension, which are shown in appendix III.

Total **Activity-Unit** for the year 1993 was 361,824.

Total cost incurred

The total cost incurred included material cost and labour cost for this object.

Material cost

Material consumed in this section were identified. Costs were obtained by reviewing purchase orders, delivery notes. Summary of the material cost were shown.

Items	Cost Incurred
Specimen cups	$ 106,972
Glasswares	$ 500
Other glasswares	$ 9,000
Test tubes	$ 500
Disposable lab wares	$ 180,000
Total	$ 296,972

Labour cost

The labour cost were obtained by summing all the staffs involved in the reception.

Rank	Staff Number	Yearly Cost
Stable MT	0.25	$ 87,703 *
Technician	1	$ 350,810 *
Attendants	4	$ 509,112
Workman II	2	$ 178,952
Total		$ 1,126,577

* These costs were the weighted averaged of a technical staff. Please refer to 3.1.

Total cost incurred

Summation of material and labour cost gave the total cost incurred in this section.

Material	$ 1,126,577
Labour	$ 296,972
Total	$ 1,423,549

Pool Rate

Total **Activity-Unit** for the year 1993 was 361,824. The total cost incurred were $ 1,423,549.

Pool rate for an activity-unit

= $ 1,423,549 / 361,824

= $ 3.93 / activity-unit

Analysis of Specimen

The direct material cost, direct labour cost and the pool rates for the three selected cost objects were reported. They were the Dimension section, the Toxicology section and the Immunoassay (IMx) section.

The Dimension Section

These section was special in that all the test shared similar labour and overhead cost, hence, the direct labour (DL), and overhead (OH) rate were identical for all tests.

The direct material (DM) costs, however, were different due to different prices and the frequencies of request.

Summary of cost

The following table summarized all cost incurred in this cost object. Each of them were further explained below.

Test Name	DM Cost	DL time	Labour Cost Rate	OH rate
	$/test	min/test	$/min	$/min DL
Albumin	0.30	0.446	2.9	1.97
Alkaline Phosphatase	0.78	0.446	2.9	1.97
Alanine Transaminase	0.88	0.446	2.9	1.97
Aspartate Transaminase	4.19	0.446	2.9	1.97
Calcium	1.50	0.446	2.9	1.97
Creatine Kinase	5.08	0.446	2.9	1.97
Chloride	0.53	0.446	2.9	1.97
Bicarbonate	42.63	0.446	2.9	1.97
Creatinine	0.22	0.446	2.9	1.97
Potassium	0.53	0.446	2.9	1.97
Lactate Dehydrogenase	1.16	0.446	2.9	1.97
Sodium	0.53	0.446	2.9	1.97
Phosphate	0.71	0.446	2.9	1.97
Total Bilirubin	1.29	0.446	2.9	1.97
Total Cholesterol	2.79	0.446	2.9	1.97
Triglyceride	3.58	0.446	2.9	1.97
Total Protein	0.90	0.446	2.9	1.97
Urate	2.25	0.446	2.9	1.97
Urea	1.86	0.446	2.9	1.97

Direct Material

We only obtained the material cost data from August to December 1993 were obtained. The cost for each individual test were shown in the above table. These were the most high volume tests in the department.

Direct Labour (DL)

During the recording period between 1 January to 31 January 1994, there were 4.5 technicians responsible for the section. The total direct labour time was 31,935 minutes. The total number of tests performed in that period was 97,365.

Hence the direct labour time per test was 0.446 minutes.

For each test performed by the Dimension section, 0.446 min was required. Multiplying this DL time by the labour cost rate gives the DL cost for one test. This DL time was also the cost driver for allocating the OH cost.

Overhead rate

These were obtained by identifying the indirect labour (IL) cost and other indirect costs incurred divided by the cost driver, which was the total DL time.

Indirect Labour (IL)

IL time was calculated by subtracting the total labour time by the total DL time. The total IL time divided by the total DL time (the cost driver) gave the IL time per minute of DL time. The IL cost was part of the overhead cost. Multiplying the IL time by the labour cost rate gave the IL component of the OH rate. Data were as follow :

Total Labour	43,470 minutes
Total DL	31,935 minutes
IL	16,365 minutes
Total DL	31,935 minutes
IL per minute of DL (IL divided by total DL)	0.512 minutes
Labour cost ratio	$2.9 / minute
IL cost per minute of DL (0.512min x $2.9)	$1.49/ minute

Parts and Maintenance cost for one year

These were the other components of the OH rate. The cost incurred for one year were divided by 12 to obtained the per month cost.

Items	Cost incurred
Parts Maintenance Contract	$ 85,050 $ 100,000
Total (for 1 year)	$ 185,050

Cost incurred for one month was obtained by dividing the cost for one year by twelve, which was $ 185,050. The cost per minute DL was derived by dividing the cost incurred for one month by the total DL for month. The result was $ 0.48 per minute of DL.

Overhead rate

This was the summation of the IL cost and the other cost.

= $ (1.49 + 0.48) min. of DL

= $ 1.97 /min of DL

Toxicology Section

These 6 tests employing the same machine naturally formed another homogenous cost object. Being a batch analyzer, the DL time for each test were different. By employing the DL as the cost driver for allocating the OH, the OH cost was

logically charged to each test.

Summary of cost

The following table summarized all cost incurred in this cost object. Each of them were further explained below.

Test Name	DM Cost	DL time	Labour Cost rate	OH rate
	$/test	min/test	$/min	$/min DL
Cyclosporin A	45.7	5.84	2.9	1.89
Carbamazepine	61.5	8.37	2.9	1.89
Phenytoin	79.1	6.33	2.9	1.89
Theophylline	82.2	7.78	2.9	1.89
Valproate	75.7	9.51	2.9	1.89
Phenobarbital	110.7	14.67	2.9	1.89

Direct Material

The DM cost were obtained by averaging the cost incurred by the number of tests in the year 1993. For detail, please refer to the above table.

Direct Labour

The direct labour time, as for those in the Dimension bench, were obtained by the time study. The total direct labour time recorded from 15 January to 14 February 1994 were 3,361 minute. This was the cost driver for charging the overhead cost.

Overhead Rate

This was obtained by identifying all other cost incurred and divided by the total DL time.

IL cost	$	3,651
Other Indirect material	$	2,744
Total	$	6,395

OH rate was obtained by dividing $ 6,395 by 3,361 minutes (DL). The result was $ 1.89 per minute of DL.

ImmunoAssay (IMx) Section

This was the third fully study cost object. All tests in this section were performed in the IMx machine. These formed another homogenous cost objects. The All the cost components are tabulated below.

Test Name	DM Cost	DL time	Labour Cost Rate	OH rate
	$/test	min/test	$/min	$/min DL
Carcinoembryonic Antigen	36.0	1.82	2.9	1.37
Oestradiol	51.6	3.06	2.9	1.37
Human Chorionic Gonadotrophin	92.8	4.08	2.9	1.37
Prostatic Specific Antigen	86.7	2.44	2.9	1.37
Ferritin	30.1	2.57	2.9	1.37
Follicular Stimulating Hormone	29.0	3.00	2.9	1.37

Post-analytical interpretation of results

The cost driver for this cost object was also the activity-unit. It was used to avoid the same problem of distortion by the Dimension tests. The only cost incurred was the labour cost of a group of Chemical Pathologist in the month June 1993. The total cost for the year 1993 was calculated by multiplying 12 to this basic month's cost.

Grade of Staff (or equivalent)	Number of days	Average daily salary & Fridge benefit
Medical Officer	6	$ 2,371
Scientific Officer	9	$ 2,077
Senior Medical Officer	10	$ 3,539
Total		$ 68,309

Total labour cost for the year 1993 :

= $ 68,309 x 12

= $ 819,708

Total **Activity-unit** for the year 1993 was 361,824.

Pool rate = $ 819,708 / 361824

= **$ 2.27/Activity-Unit**

Laboratory Information System

The results of the request-equivalent for the tests in the three sections were shown in appendix IV.

The cost incurred was the labour costs of three clerical assistants. The cost driver of this cost pool was the total number of requests for the year 1993.

Total Cost incurred for the year 1993 :

= 3 x $ 119,447 (3 Clerical Assistants)

= $ 358,341

Total Requests for the year 1993 :

= 233102

Pool rate :

= $ 358,341 / 233102

= $ 1.54 / request

For each individual test, the actual cost incurred in this cost object was the pool rate multiplied by the **request-equivalent.**

Supportive function

Costs not included in the above categories were recovered in this cost object. This included some material/overhead which were not charged into the above cost objects. A portion of the Chemical Pathologists' labour cost and some supportive staffs' labour costs were also charged to this cost object.

Material & Overhead Cost :

Items included in this section were those cannot be charged to any specific cost objects mentioned above. These included those shown in the following table. They were the cost incurred in the year 1993.

Item	Cost
Hire Service	2,000
Reference & Control	350,000
Chart & printer papers	50,000
Disp. cont. spec. coll.	250,000
Other lab. consumables	200,000
below 10,000 minor equipment	50,000
Over 10,000 minor equipment	50,000
Counters & analyzers maintenance materials	728,500
Total	$ 1,680,500

Labour Cost

All Chemical Pathologists' labour cost were estimated by the questionnaire (see appendix II). After deducting the cost charged to the post-analytical interpretation and validation of results, the following were obtained. For sensitivity reasons, the individual's cost were not shown, only the total cost of this category of staff was shown. The Chemical Pathologist's contribution to the routine services in the year 1993 was $ 6,279,128. Other supporting staffs including the Senior Medical Technologist, the secretary and other workers performing laboratory wide duty were also charged to this cost object.

Supporting staffs' labour cost :

Rank	Number	Yearly Cost
Stable MT	1	$ 648,078
Personal Secretary I	1	$ 246,065
Attendants	3	$ 381,834
Workman II	2	$ 178,952
Total		$ 1,454,929

Total cost incurred was the summation of the above costs which total to $ 9,384,557. Total number of Request (cost driver) for the year 1993 was 233,102. The **Pool rate** was obtained by dividing the total cost incurred by the total number of requests in the year 1993. The pool rate was $ 40.3 / Request. For each specific test, the cost incurred would be this pool rate times the **request equivalent.**

CHAPTER IV

DISCUSSION

Activity Base Costing (ABC) is particularly suitable for costing of laboratory tests. The traditional costing system based on one or a few cost drivers will be too crude for organisation with complex 'products' like the department studied. By establishing more logical cost pools, the cost for indirect labour, consumables and overhead can be allocated much more accurately to individual products.

Some of the cost pools, like the reception and the supporting services, are common to all tests, in case of any future change in machines/methods for any tests, changes made to the test specific cost pools (the analytical process) are all that is required to work out the cost for the tests.

This system provides much more information to the management than the traditional system. By knowing the cost incurred in different cost pools, management can identify problems in budgeting more readily.

A day to day problem faced by this department is to

choose which machine/method for continuing development. Traditionally, the cost considered in selecting methods is mainly the direct consumable cost. But some apparently 'cheap' tests have significant 'hidden' cost in terms of the indirect material consumed such as buffers, machine parts... etc. This system discloses this aspect readily.

This system enables comparison of cost between laboratories much more meaningfully. It is not very fruitful to simply compared the total cost incurred for tests between laboratories. If the cost for each components of the tests are known, it enables one to look at each component separately which can pinpoint the cause of the differences. One example is the Duty Chemical Pathologist's contribution. It is treated separately in this study. This is done deliberately to enable future comparison with other laboratories. Because the number of Chemical Pathologists employed by each laboratory varies enormously, this is potentially a big factor to explain any difference between laboratories.

Some laboratories, unlike the department studied here, do not have strong professional staffs support. This includes the Professor and the Chemical Pathologist. It is traditionally a problem in the academic department, the cost of this kind of department are usually much higher than other serving laboratory with little professional staffs. It is known that the professional staffs's cost is significant, it could also be argued that the quality provided would be much

better. But in terms of comparison between laboratories, if this component can be dissected out, the comparison would be more meaningful and give useful information about other aspects of the cost incurred.

This system is also suitable for other pathology branches such as the anatomical pathology, which has little material cost but huge direct labour cost in terms of the pathologists's time. Without minimal modification, this system can be employed to deal with other pathology branches.

This system is not without its problems. As more cost pools are used, it undoubtedly increases the accuracy of the cost estimated, but the energy involved in gathering the cost figures becomes more significant.

APPENDIX I

Development of a Costing System in Chemical Pathology, PWH. Survey on the time utilization.

Please fill up this form daily and return to the stable MT.
For explanatory notes, please see reverse side of this form.

Bench: ☐ Dimension ☐ RIA ☐ HPLC ☐ Misc. ☐ Reception

Grade: ☐ Stable MT ☐ MT ☐ MLTI ☐ MLTII ☐ Others___

☐ Mon ☐ Tues ☐ Wed ☐ Thu ☐ Fri ☐ Sat

Test 1 : _____

Number of patient samples : _____

Number of tests performed : _____
(= patient samples + controls + calibrators + repeats)

Time used : _____ Hours _____ Minutes

Test 2 : _____

Number of patient samples : _____

Number of tests performed : _____
(= patient samples + controls + calibrators + repeats)

Time used : _____ Hours _____ Minutes

Test 3 : _____

Number of patient samples : _____

Number of tests performed : _____
(= patient samples + controls + calibrators + repeats)

Time used : _____ Hours _____ Minutes

Development of a Costing System in Chemical Pathology, PWH. Survey on the time utilization. - Explanatory Notes

This is an exercise to determine the costing of our laboratory. This time study forms an important part in the estimation of DIRECT LABOUR input to the tests (this is the most important component of cost).

Please estimate your time (accurate to the 15 min., if possible) spent on various activities for each of the working day. These are divided into 2 categories :

1. Directly related to the actual analysis.
   (e.g. Searching for specimens, preparing reagents, calibration, actual analysis, keying in results, maintenance of instrument ..., i.e. all activities directly related to the production of patients' results).

2. Activities not directly related to actual analysis.
   (e.g. QC meetings, development of methods, attending departmental seminars, tea breaks, time spent on waiting for patient's specimen, idle time ..., i.e. all activities NOT directly related to the production of patients's results).

Please give an estimate of (1) for each of the test you perform daily. The working hours for a normal working day is considered to be 7 hours (4 hours for Saturday). Time for the category 2 will be deduced.

Only group means will be used for reporting purpose. Individual results will be treated confidentially. Please do not put down your name on the form.

For tests done in multiple batches, please sum all the patient samples, controls ... together and report as a single test.

For tests with a long incubation time, please DO NOT count the time during incubation if you are not doing something else related to the test.

Please use additional sheets if more than 4 tests are performed in one day and clip them together.

Note for the HPLC bench :
For the colleague responsible for maintenance of instruments remote to the laboratory (e.g. ITU, 6AB Blood gases machines), please do NOT report this activity. This will be allocated as INDIRECT LABOUR.

APPENDIX II

Development of a Costing System for the routine tests in the Chemical Pathology Department.

Professional staffs' contribution to the routine services.

Dear Colleagues,

I am required to do a project for my MBA study. To maximize the benefit of the time I spend, I take this chance to develop a costing system for our routine services. I hope that this exercise can generate some useful information for the management of the laboratory.

As all of us have multiple roles in the department such as teaching, research and routine services, it is essential to dissect out the time we spent on the routine services to make this exercise meaningful. Please help me by spending a few minutes to answer the questions on the reverse side of the page and send this sheet back to me. Your help is very much appreciated.

Yours Sincerely,

Tony Mak
14 December 1993

Explanatory Notes :

Assuming that we work 26 days a month, please estimate the time you spend on ROUTINE SERVICES.

This information will form the basis of allocating our effort as INDIRECT LABOUR to the routine tests. The activities should include things like supervision of the ROUTINE services running, method development related to the routine services, consultation to the clinician, ward round, performing the duty biochemist's job (please EXCLUDE the evening/night on call commitment), QC meetings, management meetings, providing continuing education to the ROUTINE staffs ... etc.

For the sake of consistency, the following activities are treated as not directly related to the routine services and

would not be allocated to the cost. These include all activities related to the university side, such as academic research, management of the university side, teaching of medical students and postgraduates, attending conferences (local and overseas), meetings not related to the routine services etc.

If you are not sure whether certain activities should be counted as routine services, please report these separately and specify the nature.

All data will be used as a group only. But for costing purpose, I cannot avoid asking you to put down your rank. Individual information will be treated confidentially and destroyed after the project. Please do not put down your name on the form.

If you have any queries or want to know more about the project, I am indebted to explain to you.

Rank :

☐ Professor

☐ Senior Lecturer (clinical) ☐ Senior Lecturer (NC)

☐ Lecturer (clinical) ☐ Lecturer (NC)

☐ Assistant Lecturer ☐ SMO ☐ MO ☐ SO

Time spent on routine services on a typical month :

(Assuming 7 work hours a day, 5½ days a week,
4 weeks a month)

_____ (Hours)

Time spent on services of uncertain nature / month :
(Omit this part if you do not have uncertainty)

_____ (Hours) _____ (please specify)

_____ (Hours) _____ (please specify)

APPENDIX III

Activity-unit of Dimension Tests

Test Name	Activity-Unit
1. Albumin	0.13
2. Alkaline Phosphatase	0.12
3. Alanine Transaminase	0.12
4. Aspartate Transaminase	0.16
5. Calcium	0.11
6. Creatine Kinase	0.27
7. Chloride	0.13
8. Bicarbonate	0.15
9. Creatinine	0.15
10. Potassium	0.15
11. Lactate Dehydrogenase	0.26
12. Sodium	0.15
13. Phosphate	0.11
14. Total Bilirubin	0.15
15. Total Cholesterol	0.21
16. Triglyceride	0.20
17. Total Protein	0.12
18. Urate	0.12
19. Urea	0.15

APPENDIX IV

Request-equivalent of tests

Test Name	request-equivalent
A. Dimension Section	
1. Albumin	0.097
2. Alkaline Phosphatase	0.093
3. Alanine Transaminase	0.093
4. Aspartate Transaminase	0.114
5. Calcium	0.084
6. Creatine Kinase	0.239
7. Chloride	0.231
8. Bicarbonate	0.200
9. Creatinine	0.121
10. Potassium	0.122
11. Lactate Dehydrogenase	0.229
12. Sodium	0.122
13. Phosphate	0.084
14. Total Bilirubin	0.093
15. Total Cholesterol	0.122
16. Triglyceride	0.110
17. Total Protein	0.093
18. Urate	0.090
19. Urea	0.121
B. Toxicology Section	
1. Cyclosporin A	0.986
2. Carbamazepine	0.538
3. Phenytoin	0.643
4. Theophylline	0.686
5. Valproate	0.551
6. Phenobarbital	0.499
C. Immunoassay - IMx Section	
1. Carcinoembryonic Antigen	0.671
2. Oestradiol	0.426
3. Human Chorionic Gonadotrophin	0.737
4. Prostatic Specific Antigen	0.832
5. Ferritin	0.245
6. Follicular Stimulating Hormone	0.358

APPENDIX V

Example showing the total cost incurred for a test

Test : Sodium Section : Dimension

Cost incurred in each cost object :

1. Reception

Cost incurred	=	Pool rate x Activity unit
	=	$ 3.93 x 0.15
	=	$ 0.59

2. Analysis of Specimen

DM cost	=	$ 0.53
DL cost	=	Labour cost rate x DL time
	=	$ 2.9 x 0.446
	=	$ 1.29
OH	=	OH rate x DL time
	=	$ 1.97 x 0.446
	=	0.88

3. Post-analytical interpretation of results

Cost incurred	=	Pool rate x Activity-unit
	=	$ 2.27 x 0.15
	=	$ 0.34

4. Laboratory information system

Cost incurred	=	Pool rate x Request equivalent
	=	$ 1.54 x 0.122
	=	0.19

5. Supportive function

Cost incurred	=	Pool rate x Request equivalent
	=	$ 40.3 x 0.122
	=	$ 4.92

Total	=	**$ 8.74 / Test**

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